REMARKS

Reconsideration of this application as amended is respectfully requested.

Applicants' invention is in the rotor for a rotary cutter. The cutter is designed to cut material such as hot plastic forced through extrusion dyes into small pellets. Water is provided to cool pellet quickly. The plastics which are made into pellets are very abrasive. The blades used must be from very hard materials to have an adequate working life when cutting the abrasive material. The cutter is also designed to form tons of plastic pellets per hour. To obtain such production, a large number of extrusion dye passages are required. The rotary cutters may be driven by electric motors with ratings that exceed 100 hp.

The blades as mounted on the rotor are mounted to form a helical cutter. Helical cutters are desirable to obtain a substantially constant torque load on the rotor. With non-helical cutter blades, rotors tend to produce torsional vibrations when under heavy loads. These torsional vibrations reduce cutter life and generally generate noise.

U.S. Patent No. 3,672,017 to Nielsen et al discloses a helical cutter. The helix is obtained by forming grooves with helical walls 13 as shown in Figure 5 and forming cutter blades 25 with a helical shape as shown in Figure 6.

Forming a helical cutter blade accurately is difficult. Forming a cutter blade made from a hard material such as tungsten carbide would be very difficult and expensive. Flat blades are available with accurate dimensions. These blades are made from a variety of very hard materials including tungsten carbide. The hourglass effect discussed in the specification can be reduced by using relatively

short blades and a small helix angle. The metric cutter blades used by applicants' are about 8 inches long and the helix angle is 1°. The helix angle θ used by applicants' is shown in Figure 1 of the drawing. The rotor axis 12 is on one side of the lines indicating the helix angle θ. The second line is parallel to the leading wall 26. The 1° angle will have the two lines intersecting some distance to the right of the right end 24 of the rotor 10 as shown in Figure 1.

A non-helical cutting edge of a cutter blade is either in the same plane as the axis of rotation of a rotor or in a plane that is parallel to the axis of rotation. The cutting edge of a helical blade is in a plane that intersects the axis of rotation.

A separate letter to the draftsman has been sent requesting approval to cancel the table with dimension numbers and to add a line through the rotor axis that is parallel to the plane line for the dimension Y1 in Figures 4-8 and to identify the location of the section lines in Figure 9. The dimension lines for measurements Y1 were properly shown in the drawings filed with the provisional application. Upon approval of the drawing changes, applicants' will have corrected drawings prepared for filing.

The paragraph bridging pages 4 and 5 has been amended to change "angle Ø" to -- angle θ -- to agree with the helix angle θ shown in Figure 1.

The paragraph starting on page 5, line 4 has been amended on lines 7 and 10 to change "and" to -- in --.

The paragraph bridging pages 6 and 7 has been amended on line 21 to cancel "in inches". The units used for measurement are not important because any measuring system can be used. The numbers are also useless without additional information such as the diameter of the rotor, the size of the cutter blades,

and the diameter of the envelope swepts by the cutter blade cutting edges during rotation of the rotor.

An explanation of some of the dimensions removed from the drawing Figures 4-8 is added to page 7 after line 2. These dimensions indicate some of the dimensions which change and the magnitude of the changes. The dimensions also indicate that measurements are accurate to the nearest ten thousandth of an inch.

The paragraph staring on page 7 line 8 has been amended to correct the spelling of -- block -- on line 20 as filed.

The paragraph starting on page 8, line 6 has been amended on line 7 to include the word -- sixteen -- after "total of" and to include the Greek letter -- θ -- after "helix angle" on lines 14 and 21 as filed.

The paragraph starting on page 9, line 4 has been amended to cancel "to" and insert -- of -- before "a rotor" on line 8 as filed.

Claim 1 has been amended to eliminate "wall" after both "the left end" and "the right end" on lines 11 and 12. The removal of the term "wall" provides clear antecedent basis for the terms in the claim.

The preamble of claim 1 includes "a helical rotary cutter". The phrase "and wherein said first wall plane intersects the rotor axis" is a basic definition of a helical rotary cutter. If a rotary cutter has a helix angle and a straight cutting edge, the cutting edge is in a plane that intersects the rotor axis. The helix angle θ of 1°, shown in Figure 1 indicates that the blade surfaces 60 and 62 of a blade 34 are in planes parallel to the groove wall 26 and that these planes all intersect the rotor axis 12. The location of the intersection is someplace to the right of the right end of the rotor as shown in Figure 1. The angle θ, as shown in Figure 1, indicates the location

of the intersection.

U.S. Patent No. 3,776,289 to Boboltz et al discloses a rotary cutter with a plurality of spaced apart short cutter blades 23. The sockets 14 which hold the cutter blades 23 are arranged in spaced and staggered helical rows (column 2, lines 60 and 62). The abstract states that the seating block indexes the cutting edge --- and permits blade sharpening to be done by cutting tool operable in a direction parallel to the drum axis (abstract, lines 8-11). A cutting tool that moves parallel to the drum axis would only sharper the cutter blade 23 as shown in Figure 2 if the blade is parallel to the drum axis. If the blade is parallel to the drum axis, it is not helical. No other language has been found in the patent that sets forth the orientation of a cutting blade 23 relative to the drum axis. Figures 2, 5 and 6 when taken together appear to indicate that the blade 23 is parallel to the drum axis. However, the specification does not state where the sectional view in Figure 2 was taken.

Boboltz et al holds the cutter assembly 20 above the bottom of the socket 14. The stated reason, for providing the space shown in Figure 2 between the seating block 21 and the wedge block 25, is that the depth of the socket is difficult to control (column 3, line 61-65).

U.S. Patent No. 5,163,490 to Meis discloses cutter blades 22 which are parallel to the axis 13. The cutter blades 22 are not therefore helical. A single blade 22 is mounted in each knife holding channel 14 and the head 12. The base of the blade 22, as shown in Figure 3, is unsupported.

U.S. Patent No. 3,899,813 to Lovendahl discloses a milling cutter 10 with a plurality of slots 19. Each slot has a rear face 19b and a front face 19a. The

blade 18 is clamped against the front face 19a by wedge 20 and a fastener 22. The faces 19a and 19b are in planes that are either parallel to the rotor axis or include the axis. It is not clear from the drawing or the specification if the face 19a or the face 19b are in planes parallel to the rotor axis. However, it is clear that a helix angle is not shown or suggested. Only one blade 18 is clamped to each surface 19a. The rim portion 31 of one button locator 24 sets the distance one blade 18 extends axially from the face 13 of the body 12. The blades 18 and the two adjacent slots 19 both hold a blade 18 that extends axially from the face 13'.

The surface 19a of Lovendahl that holds the blade 18 may, as stated above, be in the same plane as the axis of rotation or it may be parallel to the axis of rotation. A plane including the surface 19a and the axis of rotation cannot intersect the axis of rotation because a plane cannot intersect itself. Claim 1 as amended sets forth a first groove wall and a first wall plane, a plurality of first base support surfaces that are each in a base support plane that is perpendicular to the first wall plane and wherein all the base support planes that are perpendicular to said first groove wall intersect each other, and a plurality of cutter blades each of which is seated on one of the plurality of first base support surfaces and at least one clamp member clamping the plurality of first rectangular flat cutter blades to the first groove wall. Figure 9 of the drawing shows first base support surfaces 30, 40, 42 and 44 that are in base support planes that intersect each other. The end of surfaces at the intersections of the planes with surfaces 30 and 40 are moved radially upward from the free end of surface 30 to correct for the hourglass effect that results from the helix angle. Neither the Boboltz et al, Meis or Lovendahl disclose blades that produce an hourglass effect and do not therefore have the structure set forth above

in this paragraph.

The hourglass effect can be demonstrated by placing two spaced apart spools with the same diameter on a common axis. A string is connected to the outer periphery of both spools in a position in which the string is parallel to the common axis. One spool is rotated relative to the other spool to provide a helix angle. When there is a helix angle, the string midway between the two spools will move toward the common axis. If rotation of one spool relative to the other continues, the center of the string will eventually intersect the common axis.

The structure set forth above in applicants' claim 1 is not shown or suggested by Meis, Boboltz et al or Lovendahl.

U.S. Patent No. 3,672,017 to Neilsen et al discloses a helical cutter with helical blades. The helical blades avoid the hourglass effect. The blades 25 of Nielsen et al as shown in Figure 6 do not have parallel edges. As a result, the blades 25 of Nielsen et al are clamped to arcuate surfaces rather than flat surfaces. Nielsen et al does not therefore have the structure set forth in applicants' claim 1 as amended.

Claim 1 as amended is allowable for reasons set forth above.

Claims 2 and 3 are dependent upon claim 1 and are allowable together with claim 1 for reasons set forth above.

Claim 4 has been amended to cancel "wall" after "left end" and "right end" to provide a clear antecedent basis for the rotor end surfaces. Claims 4-6 are dependent upon claim 1 and are allowable together with claim 1 for reasons set forth above.

The allowance of claim 7 subject to being rewritten or amended to

overcome the rejections under 35 U.S.C. § 112 has been noted and is appreciated. Claim 7 has been amended to correct the antecedent basis matter as stated above. The meaning of the limitation concerning the first wall plane intersecting the rotor axis is addressed above. Intersection of the rotor axis and the first wall plane is indicated by the helix angle θ shown in Figure 1. Claim 7 as amended is therefore in condition for allowance.

Claims 8-10 are dependent upon claim 7 as amended and are allowable together with claim 7 for reasons set forth above.

The allowance of claim 11 subject to being rewritten or amended to overcome the rejections under 35 U.S.C. § 112 has been noted and is appreciated. The claim has been amended to correct the spelling of "spaced". The meaning of the phrase "said first wall plane intersects the rotor axis" is explained above. Claim 11 as amended is in condition for allowance.

New claim 12 is similar to claim 1 with the limitation "said first wall plane intersecting the rotor axis" removed. The limitations in claim 12 concerning the first groove wall in a first wall plane and a plurality of first base support surfaces that are perpendicular to the first wall plane and intersect each other are not disclosed or suggested by the cited references.

In view of the above claims 1-12, as amended, are in condition for allowance. Reconsideration and allowance is therefore respectfully requested.

A check in the amount of $42 is attached in payment of the additional claims fee.

Attached hereto is a marked-up version of the changes made to the specification and claims by the current amendment. The attachment is captioned

VERSION WITH MARKINGS TO SHOW CHANGES MADE.

The Office is authorized to charge or refund any fee deficiency or excess to Deposit Account No. 12-0755.

Respectfully submitted,

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VERSION WITH MARKINGS TO SHOW CHANGES MADE

Paragraph bridging pages 4 and 5, beginning at line 27 of page 4 and ending at line 3 of page 5 has been amended as follows:

Grooves 18, shown in Figure 2 are machined into the outer periphery 20 of the rotor 10. These grooves 18 extend from the left end 22 to the right end 24. Each groove 18 is at an angle [Ø] θ to the axis 12 to provide a helix.

Paragraph beginning at line 4 of page 5 has been amended as follows:

The grooves 18 have a leading groove wall 26 and a trailing groove wall 28. A base support surface 30 supports the base 32 of a straight flat blade 34 adjacent to the leading groove wall 26 [and] in each groove 18. A base support surface 36 supports the base 32 of a straight flat blade 34 adjacent to the trailing wall 28 in each groove 18. The groove floor 38 [and] in each groove 18 is spaced radially inward from the base support surfaces 30 and 36. The leading wall 26 of each groove 18 is in a plane that extends from the left end 22 to the right end 24. The trailing wall 28 of each groove 18 is also in a plane that extends from the left end 22 to the right end 24.

Paragraph bridging pages 6 and 7, beginning at line 19 of page 6 and ending at line 2 of page 7 has been amended as follows:

Figures 4-8 shows the location of the starting and ending points of the blade support surfaces 30, 40, 42 and 44 [in inches], in a cartesian coordinate system. The rotor 10 in the example shown in Figures 1 and 2 is a metric unit manufactured in a machining center that is programmed in inches. The machining center can also be programmed in a polar coordinate system as well as in metric units. The end result would be the same regardless of the programming employed

by the machining center.

The following paragraph has been inserted at line 3 of page 7 as follows:

The minimum distance from the axis of rotation 12 to the planes including the leading groove walls 26 and a trailing groove wall 28 is indicated by the references Y1 and Y2 respectively. The minimum distances from the axis of rotation 12 to planes including the ends of the base support surfaces 30, 40, 42 and 44 is indicated by the reference Z1. The minimum distance from the axis of rotation 12 to planes including the ends of the base support surfaces 36, 46, 48 and 50 is indicated by the references Z2. The values of Y and Z depend upon a number of factors including rotor lengths, rotor diameter, the length of the blades 34, and the angle θ of the helix.

The following chart shows the values of the distances Z1 and Z2 for a rotor with a helix angle θ of 1°, a specific length, diameter, and other variable dimensions, with the dimensions to the nearest ten thousandth of an inch.

Plane	Z1	Z2
Section 4-4 (Figure 4)	2.7350	2.7350
Section 5-5 (Figure 5)	2.6830	2.6830
Section 6-6 (Figure 6)	2.6250	2.6250
Section 7-7 (Figure 7)	2.5560	2.5560
Section 8-8 (Figure 8)	2.4830	2.4830

Paragraph bridging pages 7 and 8, beginning at line 8 of page 7 and ending at line 5 of page 8 has been amended as follows:

Two straight flat blades 34 are mounted in each groove 18 in one

groove section. One blade 34 has its base 32 on the base support surface 30 and another blade has its base on the base support surface 36. A wedge block 66 is placed between the two blades 34. Bolts 70 pass through bores 68 through the wedge block 66 and screw into threaded bores 72 in the rotor 10. When the bolts 70 are tightened, they urge the wedge block 66 toward the groove floor 38 and the axis of rotation 12, urge one blade 34 toward the base support surface 30 and the leading wall 26 and urge the other blade toward the base support surface 36 and the trailing wall 28. One wedge face 74 of each wedge [lock] block 66 contacts the front face 60 of a blade 34. The other wedge face 80 contacts the back face 62 of a blade 34. The bases 32 of the blades 34 in each groove 18 adjacent to the end 22 as well as to the end 24 are closer together than the bases of the blades on the support surfaces 40 and 46 as well as the support surfaces 42 and 48. The wedge blocks 66 are shaped to accommodate these differences in spacing. The wedge blocks 66 adjacent to the ends 22 and 24 of the grooves 18 are relatively narrow. The wedge blocks 66 that are midway between the ends 22 and 24 of the grooves 18 are relatively wide.

Paragraph beginning at line 6 of page 8 has been amended as follows:

The rotor 10 as described above has eight blades 34 in each groove 18. There are a total of [16] sixteen grooves 18 and one hundred twenty-eight blades 34. All of these blades 34 are identical to each other. As a result the blades 34 can be changed in the field and can also be sharpened in the field. The rotor 10 as described above with blades 34 that are 200 mm long, mounted on a rotor that is 200 mm in diameter and that has a helix angle θ of 1° has a decreased diameter in the center of the blade 34 of about 0.0015 ten thousandths of an inch. This is

generally satisfactory for cutting most materials. The hourglass effect can be decreased further by decreasing the length of the blades 34 and adding additional base support surfaces 30 that fit the blades. The hourglass effect can also be varied by changing the helix angle θ.

Paragraph beginning at line 4 of page 9 has been amended as follows:

The rotor construction disclosed above permits the use of standard blades 34. By using blades with a standard size, a grinder employing the rotor 10 can be repaired in the field using tools that are normally available. The repair [to] of a rotor with a few nicked blades 34 could be completed in a few minutes to a few hours. Replacement of all the blades 34 on a rotor 10 can be completed within a few hours without removing the rotor from the machine. The repair of a rotor 10 with blades that are ground to correct the hourglass effect may take a few weeks or even months.

Claim 1 has been amended as follows:

1 (Amended). A helical rotary cutter comprising:

a rotor having an outer surface, a left end, a right end, a rotor axis, a left end bearing support concentric with the rotor axis and extending axially to the left of the left end, and a right end bearing support concentric with the rotor axis and extending axially to the right of the right end;

a plurality of grooves in said rotor extending from the left end to the right end;

a first groove wall in a first wall plane extending axially from the left end [wall] to the right end [wall], extending outward away from the rotor axis and in the direction of rotation, and wherein said first wall plane intersects the rotor axis;

a plurality of first base support surfaces, that are each in a base support plane that is perpendicular to the first wall plane and wherein all the base support planes that are perpendicular to said first groove wall intersect each other;

a plurality of first rectangular flat cutter blades each of which has a left blade end, a right blade end, a cutting edge and a base that is parallel to the cutting edge and wherein the base of each of the plurality of first rectangular cutter blades is seated on one of the plurality of first base support surfaces; and

at least one clamp member clamping the plurality of first rectangular flat cutter blades to the first groove wall.

Claim 4 has been amended as follows:

4 (Amended). A helical rotary cutter as set forth in claim 1 including a second groove wall in a second wall plane extending axially from the left end [wall] to the right end [wall], extending outward away from the rotor axis and in the direction of rotation, and wherein said second wall plane intersects the rotor axis;

a plurality of second base support surfaces, that are perpendicular to said second groove wall, and that are each in a second base support plane that is perpendicular to the second wall plane and wherein all the second base support planes that are perpendicular to said second wall plane intersect each other;

a plurality of second rectangular flat cutter blades each of which has a left blade end, a right blade end, a cutting edge and a base that is parallel to the cutting edge and wherein the base of each of the plurality of second rectangular flat cutter blades is seated on one of the plurality of second base support surfaces; and

wherein the at least one clamp member clamps the plurality of second rectangular flat cutter blades to said second groove wall.

Claim 7 has been amended as follows:

7 (Amended). A helical rotary cutter comprising:

a rotor having an outer surface, a left end, a right end, a rotor axis, a left end bearing support concentric with the rotor axis and extending axially to the left of the left end, and a right end bearing support concentric with the rotor axis and extending axially to the right of the right end;

at least one groove in said rotor extending from the left end to the right end;

a first groove wall in a first wall plane extending axially from the left end [wall] to the right end [wall], extending outward away from the rotor axis and in the direction of rotation, and wherein said first wall plane intersects the rotor axis;

a plurality of first base support surfaces, that are each in a base support plane that is perpendicular to the first wall plane and wherein all the base support planes that are perpendicular to said first groove wall intersect each other;

a plurality of first rectangular flat cutter blades each of which has a left blade end, a right blade end, a cutting edge and a base that is parallel to the cutting edge and wherein the base of each of the plurality of first rectangular cutter blades is seated on one of the plurality of first base support surfaces;

a second groove wall in a second wall plane extending axially from the left end [wall] to the right end [wall], extending outward away from the rotor axis and in the direction of rotation, and wherein said second wall plane intersects the rotor axis;

a plurality of second base support surfaces, that are each in a second base support plane that is perpendicular to the second wall plane and wherein all

the second base support planes that are perpendicular to said second wall plane intersect each other;

a plurality of second rectangular flat cutter blades each of which has a left blade end, a right blade end, a cutting edge and a base that is parallel to the cutting edge and wherein the base of each of the plurality of second rectangular flat cutter blades is seated on one of the plurality of second base support surfaces; and

a plurality of clamp members each of which clamps one of said plurality of first rectangular flat cutter blades to one of the plurality of first base support surfaces, and clamps one of said plurality of second rectangular flat cutter blades to one of the plurality of second base support surfaces.

Claim 11 has been amended as follows:

11 (Amended). A method of making a helical rotary cutter comprising machining a plurality of grooves in a steel cylinder that are angularly [spaces] <u>spaced</u> from each other about a rotor axis;

machining a first groove wall, in each of said plurality of grooves, that is in a first wall plane extending axially from a left cylinder end wall to a right cylinder end wall, extending outward away from the rotor axis, and wherein said first wall plane intersects the rotor axis;

machining a plurality of first base support surfaces, in each of said plurality of grooves, that are each in one of a plurality of first base support planes that are perpendicular to the first wall plane and with the plurality of first base support planes[,] intersecting each other and wherein a right end and a left end of each of the first base support surfaces are spaced equal distances from said rotor axis;

machining a second groove wall, in each of said plurality of grooves, that is in a second wall plane extending axially from the left cylinder end wall to the right cylinder end wall, extending outward away from the rotor axis, and wherein said second wall plane intersects the rotor axis;

machining a plurality of second base support surfaces, in each of said plurality of grooves, that are each in one of a plurality of second base support planes that are perpendicular to the second wall plane and with the plurality of second base support planes intersecting each other and wherein a right end and a left end of each of the second base support surfaces are spaced equal distances from said rotor axis;

mounting a first rectangular flat cutter blade with a first cutter base that is parallel to a first cutter cutting edge on each of said plurality of first base support surfaces;

mounting a second rectangular flat cutter blade with a second cutter base that is parallel to a second cutter cutting edge on each of said plurality of second base support surfaces; and

clamping the first rectangular flat cutter blades and the second rectangular flat cutter blades in the plurality of grooves.

Add claim 12.